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USING PEER COMPUTER-MEDIATED CORRECTIVE FEEDBACK TO SUPPORT EFL LEARNERS' WRITING

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This study investigated the effect of using computer-mediated corrective feedback on EFL learners' performance in writing. Sixty-four intermediate-level learners were randomly assigned to either a no-feedback control condition or a corrective feedback, including three treatment conditions. The first is the "track changes" feature of *Microsoft Word 2010* which double strikes through deletions and marks insertions in a different color. The second is recast feedback while the third is metalinguistic feedback. Over the course of eight weeks, each student was required to provide corrective feedback on drafts written by another group member and to discuss it with the group members. The study yielded three major findings. First, students who received computer-mediated corrective feedback while writing achieved better results in their overall test scores than students in the control condition who did not receive feedback. Second, there was a significant effect for the track changes made in the corrective-feedback type when compared with that made in the recast and metalinguistic feedback types. Students in the recast treatment condition also obtained higher significant mean scores than those who received metalinguistic corrective feedback. The study concluded with suggestions for further research and pedagogical implications.

Keywords: Corrective feedback, foreign language writing, computer-mediated communication, peer review, error type.

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INTRODUCTION

Corrective feedback is one of the major tools used for enhancing English language learning and teaching by providing students with feedback to correct their errors. It may support learners with explicit or implicit feedback that may be useful in developing writing. Although corrective feedback has been used for a long time in traditional classrooms, computer-mediated corrective feedback has been introduced only recently. The user may have access to different types of computer-based facilities that may help in providing corrective feedback for students regarding their errors and mistakes. According to Yeha and Lob (2009), corrective feedback or error correction provided via written computer-mediated communication could play an important role in developing learners' metalinguistic awareness, especially marking up text with colored annotations and focusing the learners' attention on limited information. This makes corrective feedback an efficient way to draw learners' attention to the error and the feedback about it in the written text. As the use of computer-mediated corrective-feedback method has become more common in writing classes, different studies have looked for more innovative ways to aid learners in developing their writing abilities (Hyland & Hyland, 2006), and called for a test of the effectiveness of new technologies on teaching learners how to write (Ware & Warschauer, 2006). Moreover, as "the computer is a pedagogical tool that needs to be carefully used, evaluated, and explored by pedagogues and researchers alike" (Caws, 2006, p. 20), there is a need to search for more helpful computer-mediated

corrective-feedback methods and techniques that may support students when receiving peer-corrective feedback in a manner that may aid them more in the development of their writing performance. Despite the fact that some studies were conducted on the effectiveness of computer-mediated corrective feedback on learners' writing performance, the present study is based on introducing new computer-mediated corrective-feedback types for learning and teaching writing, including track changes and its effect on developing learners' performance in seven writing aspects: content, structural organization (text level), structural organization (sentence level), grammatical accuracy, lexical appropriateness, punctuation, and spelling.

Corrective Feedback and Language Learning

Some studies focused on providing feedback only on grammar (Bitchener, Young, & Cameron, 2005 & Ferris, 2006), content (Ferris, 2004 & Hendrickson, 1978), or on both (Arnold, Ducate & Kost, 2009; De Jong, & Kuiken, 2012; O'Donnell, 2007; Sheppard, 1992; Van Beuningen, 2010; Vyatkina, 2011). Though the term "corrective feedback" is generally used for errors on form not content, it may mean different things for the readers. Corrective feedback in this study refers to both feedback on linguistic forms and content (e.g., rhetorical aspects of writing) in the computer-based written form. Corrective feedback or error correction may aid learners' writing development and can act as a functional method for language learning. Van Beuningen (2010) reports that it fosters language learning and develops accuracy as it offers learners opportunities to notice the gaps in their linguistic systems, testing interlanguage hypotheses, and engaging in metalinguistic reflection. The accuracy of students who received written corrective feedback in the immediate post-test outperformed those in the control group, and this level of performance was retained two months later (Bitchener, 2008).

Many studies, particularly by Truscott (1996, 2009), raised objections to corrective feedback use and pointed out that corrective feedback is unhelpful or even harmful for students' writing development (Truscott & Hsu, 2008). In conclusion, the usefulness of written corrective feedback is a topic of considerable debate (Ferris, 2004, 2010, 2012; Truscott, 2007, 2009). According to Guénette (2007), there has been considerable controversy among theorists and researchers about the usefulness of the process of corrective feedback in language learning and teaching. He added,

> The debate continues between those who believe in giving corrective feedback to students to improve their written accuracy and those who do not. Indeed, the results of the many experimental studies on written corrective feedback carried out over the last 20 years have been so contradictory that second language teachers looking to support their pedagogical choice to correct, or not to correct, the grammar of their students' written production are left in the midst of controversy. (p. 40)

For the researchers who believe in the effect of corrective feedback on students' writing, different types of corrective feedback can be used to aid students' writing development including explicit error correction, metalinguistic feedback, elicitations, repetitions, recasts, translations, clarification requests (Lyster & Ranta, 1997), and reformulation of correcting error types (Santos, López-Serrano, & Manchón, 2010). Other studies (Ellis, 2004; DeKeyser, 1998; Sauro, 2009) referred to two types of corrective feedback, including explicit and implicit or conscious knowledge about error vs. procedural knowledge. Another classification is based on conceptualizing the feedback types as indirect or direct feedback (Ferris, 2003, 2006; Truscott & Hsu, 2008) where "direct CF [corrective feedback] consists of an indication of the error and the corresponding correct linguistic form, [while] indirect CF only indicates that an error has been made" (Van Beuningen, 2010, p. 12). There are also other subcategorizations of these major types. For instance, indirect corrective feedback is divided into underlining and codes (Chandler, 2003; Ferris & Roberts, 2001), while the effect of direct feedback is examined as direct corrective feedback with or without written metalinguistic explanations (Bitchener, 2008; Bitchener & Knoch, 2009).

In this study, three types of corrective feedback are used, namely track changes, recast, and metalinguistic.

Table 1 illustrates these types. The examples are based on the sentence: *They speaks English fluently.* The definitions for the terms *recast* and *metalinguistic* feedback and the categorization of the characteristics of these corrective-feedback types are based on the model introduced by Lyster and Ranta (1997) and Sauro (2009). However, the definitions are operationalized and adapted to suit this study.

Table 1. *Characteristics of Corrective-Feedback Types in Microsoft Word 2010*

Feedback type	Definition	Location in text	Example	Nature of error indicated	Target-like reformulation provided	Elicited output
Track changes	It is a computer-mediated method for providing corrective feedback that can be used in an implicit or explicit manner. It is based on reformulation of the error where the program strikes through deletions and marks insertions in a different color.	Inline	*They ~~speaks~~ speak English fluently.*	Provided indirectly	Yes	Error is identified and reform-ulated
Recast	It is a computer-mediated method used for providing feedback. The error is always reformulated without providing any metalinguistic information about it.	Marginal comment displayed inline	They speak English fluently.	Yes	Reformulation provided	Repeti-tion of the error in the correct form
Metalinguistic feedback	It is a computer-mediated method based on providing metalinguistic information or comment about the error without reformulating it.	Marginal comment displayed inline	*Subject-verb agree-ment*	Yes	Provided indirectly	Refor-mulation of error

On the other hand, the location in text characteristics of feedback types represent an attempt made in this study to specify where and how the note is displayed in the text. Figure 1 also provides an illustrative example about computer-mediated corrective-feedback types.

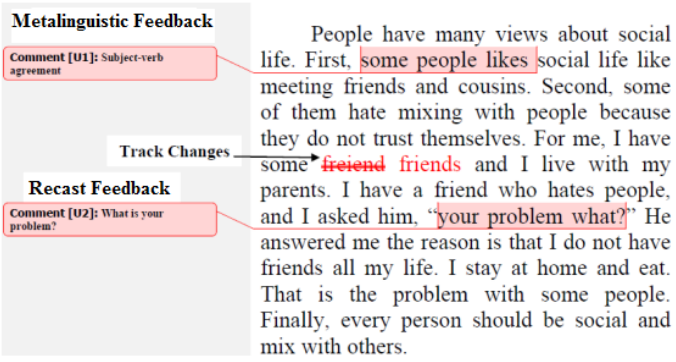

Figure 1. A screenshot for computer-mediated corrective-feedback types. Here, marginal comments are used for clarification to the reader, but they were displayed in line for students.

Peer written Corrective Feedback

The peer-written corrective feedback is based on the Vygotsky's (1978) sociocultural theory. That is, the computer-mediated environment helps learners to provide corrective feedback about writing errors where one can achieve more when they interact with peers than when they work alone. Wells (1999) also demonstrated that the cooperative context helps the learners to receive help from their peers in the cooperative activity. It is a learner-centered approach based on learners' interactions to correct their errors. The learning process is considered as collaborative and cooperative (Oskoz & Elola, 2011). Therefore, peer-written corrective feedback is based on the communicative approach which is different from the traditional method that focuses on teaching isolated linguistic features and grammatical rules. It aims at developing learners' ability to use language in meaningful communication where they help each other to develop their linguistic competence while interacting. Inspired by the theory of communicative competence introduced by Canale and Swain (1980), this study focused on creating opportunities for asynchronous peer written interaction and meaningful communication. It is based on providing peer written corrective feedback where each student reads essays written by other classmates and provides written corrective feedback about their errors.

The major goal of peer-written corrective feedback is to foster an atmosphere of reciprocal learning between learners based on the communicative approach to language teaching (Savignon, 2002). Ho and Savignon (2007) also reported that numerous studies have explored aspects of peer-review activities, including learners' reactions and negotiation patterns, the effects of peer response on learners' writing, and learners' attitudes and affective benefits. Studies conducted to identify the effect of peer-written corrective feedback on learners' writing abilities (Elola & Oskoz, 2010; Ho & Savignon, 2007; Ware & O'Dowd, 2008) reported that it is quite helpful for learners to focus more on structure and organization, as well as content because they work collectively to address different types of errors in a cooperative environment. Finally, this study focused on the effect of asynchronous, computer-mediated, peer-writing corrective feedback. "One main benefit of CMC in asynchronous writing environments is that it promotes collaboration amongst students and reduces inhibition towards communication" (Caws, 2006, p. 20).

Other studies made comparisons between presenting computer-mediated corrective feedback cooperatively and individually. For example, Elola and Oskoz (2010) made a comparison between learners' peer-writing performance and individual writing performance using wikis and chats. Findings showed that there were no statistically significant differences in terms of complexity, accuracy, and fluency when comparing the individual and collaborative assignments. Finally, another study (Arnold, Ducate, & Kost, 2012) compared students' revisions only (cooperation) and their revision for the essays as a whole (collaboration). The results indicated that learners used both cooperative and collaborative strategies to revise for form. However, they were more cooperative when they made content revision. Finally, peer-revision computer-based collaborative writing created an environment which helped learners to state their views and to reorganize their essays (Oskoz & Elola, 2011), to contribute to autonomy through providing opportunities for practicing language (Kessler, 2009), and to develop their writing skills (Lee, 2010).

Error Type

There are two major different error types that address both content and form, including focused and unfocused (Ellis, Sheen, Murakami, & Takashima, 2008), treatable or rule governed (e.g., article use) and untreatable (e.g. lexical use) (Ferris, 2002), or targeted and untargeted (Storch, 2010) error types. According to Van Beuningen (2010, p. 11), focused corrective feedback "targets a (number of) specific linguistic feature(s) only" while unfocused corrective feedback "involves correction of all errors in a learner's text, irrespective of their error category." Despite the fact that some studies (Sheppard, 1992) focused on classifying error types into global vs. local, other studies (Arnold, Ducate & Kost, 2009; O'Donnell, 2007; Vyatkina, 2011) provided more detailed types, including content, structural

organization (text level), structural organization (sentence level), grammatical accuracy, lexical appropriateness, punctuation, and spelling. Moreover, research has also explored the effect of corrective feedback on separate error types. Ferris (2006), for example, discerned between five major error types related to verb, noun, article, lexicon, and sentence, while Bitchener, Young, and Cameron (2005) distinguished between three error types (past simple tense, articles, and prepositions).

Research about the effectiveness of corrective feedback proposes focusing on global error types rather than local errors since they impair communication (Hendrickson, 1978). However, other studies recommended focusing on both content and form, and different types of feedback should be used to address both content and form (Ferris, 2003, 2006; Hyland & Hyland, 2006; Lee, 2010; Sheppard, 1992; Vyatkina, 2011). This may help learners focus on both local error correction and global revision related to different writing aspects, including content, organization, and form. Thus, based on these studies, the evidence in support of writing corrective feedback on a limited number of error types is not very strong. Moreover, research did not generally support conducting studies based on a limited number of errors. For example, Ferris (2010) noted that the purpose of error correction is to improve writing accuracy in general and not just to use one grammatical structure, though exploring the effect of focused error types might not be functional in improving learners' performance in writing from a practical perspective. Similarly, Storch (2010) demonstrated among other things that it is questionable whether we can draw generalizations about the efficacy of writing corrective feedback based on the evidence from such a limited range of structures. She added, "Studies which provide feedback on one type of error and only on one piece of writing and in controlled environments are unlikely to be relevant to language teachers" (p. 43). Other studies (Storch, 2010; Van Beuningen, 2010;) recommended provision of feedback within a realistic writing context to enable valid assessment of the role of corrective feedback in language-learners' written-accuracy development. That is, learners provide corrective feedback on different error types as they learn how to write.

Studies (DeKeyser, 2007; Ferris, 2004) suggested that the administration of extensive and sustained meaningful exposure and practice is effective in language learning and recommended the incorporation of feedback on content even at earlier stages of language instruction. This study is concerned with this issue. It provides a writing context in which students' writing performance was investigated over eight weeks to enable a valid assessment of the role of corrective feedback in language-learners' written-accuracy development and in which the writing aspect was mainly developed by computer-mediated corrective feedback. The marking scale used by Vyatkina (2011, p. 73) related to the seven writing aspects was adopted. Appendix A contains this study's operational definitions for each of the seven writing aspects, examples about them, metalinguistic feedback, and reformulation of the error.

Computer-mediated Corrective Feedback

Though many studies have face-to-face comparison for certain types of corrective feedback over others (Russell & Spada, 2006), there is a limited number of outcome-based studies on peer-writing corrective feedback in computer-mediated communication (CMC) tools like using wikis and chats (Elola & Oskoz, 2010), and Word (AbuSeileek, 2006). Some studies (Caws, 2006; Duff & Li, 2009; Ho & Savignon, 2007,) have focused on investigating the effect of computer-mediated corrective-feedback method using WebCT, email and Word on participants' attitudes, and reported that it was quite helpful for the development of students' writing. Lee (2005) also demonstrated that web-based learning reinforced learners' communication skills and writing, and actively involved them in being responsible for their learning. Other studies (Ho & Savignon, 2007; Savignon & Roithmeier, 2004) found that computer-mediated peer review based on online-text discussion offers flexibility for learners as it reduces psychological pressure on learners who do not like to give feedback in face-to-face situations because it allows them to offer remote feedback asynchronously at the learners' convenience.

Furthermore, other researchers compared between computer-mediated corrective feedback and traditional

feedback. For example, Yeha and Lob (2009) developed an online corrective feedback and error analysis system called Online Annotator for EFL Writing. The system consisted of five facilities: Document Maker, Annotation Editor, Composer, Error Analyzer, and Viewer. The findings indicated that students' corrective feedback revealed significantly better performance in the experimental group on recognizing writing errors. Moreover, Liu and Sadler (2003) also explored whether differences in both modes of commenting (Microsoft Word) and interaction (MOO) were more effective than traditional instruction in writing. The findings show that the overall number of comments, the percentage of revision-oriented comments, and consequently the overall number of revisions made by the technology-enhanced group were larger than those made by the traditional group. However, the study suggested using *Microsoft Word 2010* for editing in an electronic peer review mode, combined with face-to-face interaction in the traditional peer-review mode, for effective peer-review activities in L2 writing classrooms. Moreover, wikis were found to be an effective educational tool that encouraged the revision behavior and collaborative writing skills, and collaborative electronic writing may enhance more revisions (Arnold, Ducate, & Kost, 2009).

In conclusion, the number of computer-mediated studies examining the effect of corrective-feedback types was too limited to argue for the advantage of this method compared with the traditional method or type of corrective feedback, though many studies showed that CMC was very helpful for developing learners' performance in writing (AbuSeileek, 2012; Sotillo, 2000; Ware & Warschauer, 2006). The present study aims to introduce a new corrective-feedback type of track changes that may be different from the other types used in previous studies. Using this method, the learner can strike through deletions and mark new insertions in the text in a different color where the error is identified indirectly and reformulated. This makes using track changes a combination of both implicit and explicit corrective-feedback types. Furthermore, the study used different feedback types to address both content and form, including focused and unfocused error types. It sought to determine the effect of corrective-feedback type on EFL learners' performance in different writing aspects, including content, structural organization (text level), structural organization (sentence level), grammatical accuracy, lexical appropriateness, punctuation, and spelling. It seemed that no studies have investigated its effect on developing learners' proficiency in different writing aspects, including correcting local and global errors over a long period using the track changes method. Consequently, this was a major goal of this study.

THIS STUDY

1. This study investigated the effect of using peer-generated computer-mediated corrective feedback on EFL learners' performance in writing. It also explored how three types of computer-mediated corrective feedback (track changes, metalinguistic, and recast) support EFL writing. More specifically, it sought to answer the following three research questions:
2. Do learners who receive computer-mediated corrective feedback from their peers perform significantly better when writing post-tests than those who do not receive feedback?
3. Which type of computer-mediated corrective feedback (track changes, recast, or metalinguistic) is more effective for EFL learners' writing performance?
4. Which writing aspect (content, structural organization (text level), structural organization (sentence level), grammatical accuracy, lexical appropriateness, punctuation, and spelling) is mainly developed by computer-mediated corrective feedback (track changes, recast, or metalinguistic)?

Participants and Design

Sixty-four undergraduate participants were enrolled in a writing course in a university. The course aimed at improving students' written English communication. This included improving learners' ability to generate, organize, compare, contrast, and develop ideas supported by examples or evidence. Students in

this class were freshmen in the Department of English. A survey was done for their age, gender, and language capabilities. Their age range was 18.3–19.1 years. The sample consisted of 48 females and 16 males. However, the four study groups were balanced in their composition with twelve females and four males assigned to each group.

A score range between 68 and 75/100 in the university's English Placement Test is considered as an intermediate level and is roughly equal to level 5 on the IELTS, FCE, and CCSE, level 2 on the Cambridge exams, AP according to the ARELS exams, and OP according to the Oxford exams. Based on their scores, the 64 participants were placed in the intermediate linguistic level. They were randomly assigned into four groups (one control and three experimental) of sixteen students each. The MANOVA which was run on pre-test scores found no statistically significant difference between the computer-mediated groups (N = 48; mean = 24.19; standard deviation = 1.93) and the control group (N = 16; mean = 23.63; standard deviation = 1.79); $F(1,63) = 1.06$, $p = .31$. The MANOVA test also showed that there was no significant effect for computer-mediated corrective-feedback type, $F(2,47) = 1.06$, $p = .31$, on the writing pre-test for all groups: track changes (N = 16; mean = 24.19; standard deviation = 2.26), recast (N = 16; mean = 24.38; standard deviation = 1.82), and metalinguistic (N = 16; mean = 24.00; standard deviation = 1.79). This indicates that all four groups began with similar levels of writing ability.

The same instructor taught all of the participants in this study. Moreover, all students studied the same material and wrote eight essays over the same period: eight sessions over eight weeks. Students were informed that they were participating in a study that was being conducted solely for academic purposes. They were also informed that their participation in the study would not affect their evaluation in the course. To reduce the possibility of students' sharing what they were doing in each group, they had access to the materials and used the computer-mediated techniques only during the lessons. Due to the absence of some students, the instructor was forced to postpone two lessons (one for the track changes group and the other for the metalinguistic group) in order to enable all students in different groups to participate in the discussions.

Test

For the purposes of this study, a test was designed by the researchers to gauge the effect of the corrective feedback-type on EFL learners' writing abilities. It aimed at measuring students' ability to write correctly in English, including the ability to generate, organize, compare, contrast, and develop ideas, and to support those ideas with examples or evidence. Two raters, a native speaker and an EFL instructor, who were applied linguists, validated the test with regard to the clarity of instructions and the suitability of the questions to the goals and content of the course. They presented several suggestions such as changing the marking scale. Their suggestions and comments were taken into consideration. The test consisted of two main questions.

The first question required students to write an essay of 150–200 words within a 30-minute time limit. For this question, the marking scale included the following seven writing aspects: content, structural organization (text level), structural organization (sentence-level), grammatical accuracy, lexical appropriateness, punctuation, and spelling. Each writing aspect received ten points, with a maximum question score of 70 (Table 2).

Table 2. *Writing Scoring Rubrics*

Question	Writing aspect	Number of errors	Points
1. Write an essay	Content		10
	Structural organization (text level)		10
	Structural organization (sentence level)		10

	Grammatical accuracy		10
	Punctuation		10
	Lexical appropriateness		10
	Spelling		10
	Total		70
2. Underline and correct errors	Content	5	10
	Structural organization (text level)	5	10
	Structural organization (sentence level)	5	10
	Grammatical accuracy	5	10
	Punctuation	5	10
	Lexical appropriateness	5	10
	Spelling	5	10
	Total	35	70

The second question required each student to search and correct, also in 30 minutes, a writing sample that had 35 errors covering the seven writing aspects. Each writing aspect received ten points, two points for each error, with a maximum question score of 70 (Table 2). Each student was required to underline the error and identify the type. The test re-test technique was used to establish the reliability of the test. The test was administered twice to a pilot study of twenty students within a two-week period between the two tests. The reliability coefficient of the test was .83, which is statistically acceptable for the purposes of the study. Before the test, students were briefed about its components and the criteria to be used in assessing their work. Each essay was scored by the same two raters who jointly assessed five of the essays and discussed points of disagreement until a consensus was obtained. Each essay was then rated independently by the two raters. Neither of them knew the rating assigned by the other. The inter-rater reliability between them was .86, which was statistically acceptable for the purposes of this study. It should be noted that the research questions in this study were addressed through the writing pre- and post-tests. However, students' essays were analyzed only to address the extent to which corrective feedback was delivered for each writing aspect and corrective-feedback type.

Description of Procedures and Instructional Treatment

Students were surveyed about personal information. They were then assigned into four treatment groups of 16 students each. Each of them was also randomly assigned into four small cooperative groups of four students each. All the writing tasks, including providing the corrective feedback, were conducted in the computer laboratory using *Microsoft Word 2010* under the supervision of the instructor. Each student was set in front of a computer. They had to write an essay of 150–200 words about a specific topic. The topics included describing a person, describing a place, the similarities/differences between two things, hobbies, how to spend spare time, telling a story, a journey, and the Internet. Each student then submitted their work to the instructor. To reduce students' anxiety about making mistakes and errors, they were instructed not to write their names on the drafts; numbers were used instead. Each student in the small cooperative groups wrote one essay in each session. The teacher then assigned each student in the group one essay to be corrected. Each of them worked individually to provide corrective feedback related to the seven writing aspects in the draft written by another student from the group. Each group then had face-to-face discussion about the corrective feedback provided by each of its members about the errors in the draft

he/she had checked. This step was adopted to help them trust the corrective feedback from their peers who were still developing their own writing proficiency (Paulus, 1999). Students did not directly receive teacher corrective feedback about their errors. However, each group then checked the corrective feedback they provided about the errors in the drafts with their instructor as an additional step to instill confidence in the feedback. Finally, the essays with corrective feedback were brought back to the instructor who sent each student his/her essay, a procedure that ensured confidentiality. Then each student worked alone to revise and rewrite his/her draft, considering the corrective feedback he/she had received.

The instructor familiarized the participants in all groups with the target writing aspects. He also trained them to provide different types of corrective feedback as well as strategies to avoid when providing their own corrective feedback about the writing aspects. Four instructional treatments were included in the present study: track changes, recast, metalinguistic, and no feedback. In the first treatment, students commented on their peers' writing by using the track changes feature of *Microsoft Word 2010*. From the Review menu, the student used the option Track Changes. It allowed the learner to double-strike through deletions and to insert changes and mark them in red without providing metalinguistic information. In the second treatment, recast feedback, the student used the option New Comment from the Review menu. Comments were displayed inline through the option "Show All Revisions Inline" which can be reached through Show Markup and then Balloons in the Review menu in *Microsoft Word 2010*. Students had to reformulate learners' errors related to the seven writing aspects without providing any metalinguistic information about the error. The third group used the same comment format; however, each student in this group had to provide metalinguistic information related to the seven writing aspects without reformulating the error. Finally, the fourth treatment was the control group in which no corrective feedback was provided by peers or the instructor. Each student worked alone on the writing task. However, students in this group received feedback once the study was finished because it was a long time for them not to receive feedback. All participants were post-tested, and their writing mean scores were analyzed per the study variables. Table 3 shows the extent to which corrective feedback was delivered for each writing aspect and corrective-feedback type. Based on the table, the amount of corrective feedback each group received was comparable as there were no statistical differences in the mean error between the corrective-feedback types as well as the writing aspects for each group ($F(2,47) = 0.07$); $p = .13$.

Table 3. *Total Errors and Mean Errors for Corrective-feedback Types and Writing Aspects*

Writing aspect	Corrective feedback type						Total	
	Track changes		Recast		Explicit			
	Total errors	Mean error	Total errors	Mean error	Total errors	Mean error	Total errors	Mean error
Content	68	4.25	73	4.56	72	4.5	213	13.31
Structural organization (text level)	58	3.63	49	3.06	62	3.88	169	10.57
Structural organization (sentence level)	152	9.50	147	9.19	157	9.81	456	28.50
Grammatical accuracy	186	11.63	195	12.19	190	11.88	571	35.70
Punctuation	167	10.44	154	9.63	168	10.50	489	30.57
Lexical appropriateness	81	5.06	86	5.38	79	4.94	246	15.38
Spelling	164	10.25	174	10.88	170	10.63	508	31.76
Total	876	54.76	878	54.89	898	56.14	2652	165.79

Statistical Analysis

Means and standard deviations were calculated for either a no-feedback control condition or a corrective-feedback treatment including one of the three types: track changes, metalinguistic, or recast. To find the

presence or absence of any effect of computer-mediated corrective feedback on EFL learners' performance in writing, and explore how the three types of computer-mediated corrective feedback supported EFL writing, a MANOVA test was administered to the overall scores of students who participated in this study. Scheffe post-hoc tests were also conducted to compare any differences among the different groups in corrective-feedback types. Descriptive statistics, including mean scores and standard deviations, and the MANOVA test, relating to the seven writng aspects in the third question of the study, were calculated. Post-hoc Scheffe multiple comparisons were calculated to find the effect of corrective-feedback type on the seven writing aspects. The corrective-feedback types were the independent variables, and the students' mean scores on the 'writing post-test' and 'writing aspects' were the dependent variables.

RESULTS

Corrective Feedback Types

Question number one sought to determine whether learners who received computer-mediated corrective feedback from their peers while writing performed significantly better on the writing post-test than those who did not receive feedback. Table 4 lists the means and standard deviations of the students' scores on the post-test comparison of those means (*F* values). The data in Table 4 show that the overall mean of students' scores in the experimental condition was significantly higher than that of the students' scores in the control group on the writing post-test ($F(1,63) = 27.65$, $p = 0.00$). In other words, the MANOVA test showed that the computer-mediated groups had significantly higher mean scores than the control group who did not receive corrective feedback from their peers about their writing errors. Moreover, the standard deviation is double in the group that received feedback, indicating that students in this group did not receive homogeneous mean scores on the writing post-test. As the instructor worked to ensure that all students had the same opportunity to participate in the writing sessions, except getting or not getting peer corrective feedback, the main significant effect for corrective-feedback type in this study may be attributed to receiving and giving computer-mediated corrective feedback by the sample while learning to write (Table 4).

Table 4. *MANOVA of Students' Scores on the Post-test for Corrective-feedback Types*

Corrective feedback	N	Mean	Standard deviation	*F*
Computer-mediated feedback	48	49.04	4.37	27.65*
Control	16	41.44	1.93	

*Note: * $p < 0.05$.*

Computer-mediated Corrective-feedback Types

Question number two required students to indicate which type of computer-mediated corrective feedback (track changes, recast, or metalinguistic) was more effective for EFL learners' performance on the writing post-test. Table 5 presents the results of a MANOVA of students' post-test scores for the three computer-mediated corrective-feedback types.

According to the table, there was a significant effect for the computer-mediated corrective-feedback type on the students' scores on the writing post-test ($F(2,47) = 127.10$, $p = 0.00$). Post-hoc comparison (Scheffe test) shows that the track-changes treatment group significantly outperformed the other groups. The recast group also significantly outperformed the metalinguistic group ($p = 0.01$) (Table 6). These findings show the following order of the effect of computer-mediated corrective-feedback type on EFL learners' writing performance on the post-test from strongest to weakest: track changes > recast > metalinguistic. As the three treatment groups had the same treatment conditions and opportunities for

participation and commenting, except the different computer-mediated corrective-feedback type, it can be concluded that the main significant effect here could be attributed to the feedback type. That is, the track changes feedback type tends to have the most significant positive effect on EFL students' writing, followed by recast feedback, and then metalinguistic feedback type.

Table 5. *MANOVA of Students' Scores for the Computer-mediated Corrective-feedback Type on the Writing Post-test*

Feedback type	N	Mean	Standard deviation	*F*
Track changes	16	54.00	2.16	
Recast	16	48.89	1.63	127.10*
Metalinguistic	16	44.26	1.29	
Total	48	49.04	4.37	

*Note: * p < 0.05*

Table 6. *Results of Scheffe Test for Computer-mediated Corrective-feedback Type on the Writing Post-test*

Feedback type	Recast		Metalinguistic	
	MD	Sig.	MD	Sig.
Track changes	4.19*	0.00	7.94*	0.00
Recast			3.57*	0.00

*Note: * p < .05.*

Effect of Corrective-feedback Types on Writing Aspects

The third question sought to determine which writing aspects the computer-mediated corrective feedback (track changes, recast, or metalinguistic) developed the most. Table 7 shows the means and standard deviations for the writing aspect by computer-mediated corrective-feedback type on the writing post-test.

Table 7. *MANOVA of Students' Scores for Computer-Mediated Corrective-Feedback Type on the Post-Test in Writing Aspects*

Writing aspect**	Corrective feedback type						*F**
	Track changes		Recast		Metalinguistic		
	M	SD	M	SD	M	SD	
Content	8.06	0.93	7.00	0.73	6.25	0.58	23.02*
Structural organization (text level)	8.25	0.77	7.38	0.89	6.19	0.75	26.44*
Structural organization (sentence level)	8.25	0.86	7.06	0.68	6.13	0.62	34.47*
Grammatical accuracy	8.38	0.62	7.31	0.95	6.31	1.01	22.12*
Punctuation	8.38	0.62	7.50	1.10	6.38	0.62	24.53*
Lexical appropriateness	6.06	1.24	6.50	0.52	6.56	0.51	1.73
Spelling	6.63	0.50	6.13	0.81	6.44	0.63	2.36
Total	54.00	2.16	48.89	1.63	44.26	1.29	127.10*

*Note: * p < 0.05; ** The maximum score for each writing aspect is 10.*

According to the table, the MANOVA test revealed that students in the track-changes group obtained more mean scores in all writing aspects except two, lexical appropriateness and spelling, at the $p < .05$ level. A post-hoc Scheffe test also indicated that there was a significant effect for writing aspect between the track-changes group and the other two groups (recast and metalinguistic) in favor of the track-changes group in all writing aspects, except lexical appropriateness and spelling (Table 8). This seems to indicate that the track-changes feedback was more effective for learning the five writing aspects than the other feedback types (recast and metalinguistic) on the writing post-test in the present study. However, the Scheffe Test shows that there were no significant differences between corrective-feedback types (track

changes, recast, and metalinguistic) in lexical appropriateness and spelling ($p = 0.01$), indicating that students in the three computer-mediated corrective-feedback groups in this study could develop the two writing aspects (lexical appropriateness and spelling) in the same way in the writing post-test. The post-hoc comparison (Scheffe Test) also shows that the recast group significantly outperformed the metalinguistic group in all writing aspects except lexical appropriateness and spelling at the $p = .01$ (Table 8). This appears to suggest that the recast corrective-feedback type is more helpful for the participants in learning the writing aspects than the metalinguistic corrective-feedback type. As the instructor worked to ensure that participants in all treatment conditions had similar opportunities to locate errors and to correct them except the different corrective-feedback types, it can be concluded that the main significant effect related to the writing aspects could be attributed to the corrective-feedback type from track changes.

Table 8. *Results of Scheffe Test for Writing Aspect by Computer-mediated Corrective-feedback Type on the Writing Post-test*

Writing aspect	Recast		Metalinguistic	
	MD*	Sig.	MD*	Sig.
Content	1.06*	0.00	1.81*	0.00
			0.75*	0.03
Structural organization (text level)	0.88*	0.01	2.06*	0.00
			1.19*	0.00
Structural organization (sentence level)	1.19*	0.00	2.13*	0.00
			0.94*	0.00
Grammatical accuracy	1.06*	0.01	2.06*	0.00
			0.94*	0.00
Punctuation	.88*	0.01	1.13*	0.00
			1.13*	0.00
Lexical appropriateness	-0.44	0.34	-0.50	0.24
			-0.06	0.98
Spelling	0.50	0.11	0.19	0.72
			-0.31	0.41

*Note: * The mean difference is significant at the 0.05 level.*

DISCUSSION

Corrective Feedback Types

The findings of this study affirm that learners who received corrective feedback delivered via computer about error types while writing essays performed significantly better than those who did not receive corrective feedback. Providing computer-mediated corrective feedback by peers seemed to have enhanced students' writing performance. This finding may be attributed to two reasons. The first is that the sample of the study may need more help than other groups of learners, such as advanced learners or native speakers, as it consisted of intermediate level EFL learners. Second, students in the treatment conditions used the computer to provide corrective feedback about errors in their classmates' essays. Most likely, the computer might support them to improve their writing performance. This finding has been supported by other studies conducted to identify the effect of computer-mediated corrective feedback on both form and content (Arnold, Ducate, & Kost, 2009; Liu & Sadler, 2003; Yeha & Lob, 2009). They found that the corrective feedback delivered via computer was quite useful for the development of students' writing

abilities on post-tests. Similarly, Savignon and Roithmeier (2004) and Ho and Savignon (2007) found that computer-mediated written corrective feedback has the ability to foster language learning and to help learners in finding errors and correcting them.

The present study also lasted over eight weeks and included different writing aspects, focusing on both content and form. Studies that explored the effect of corrective feedback on students' writing development (Ferris, 2003, 2006; Hyland & Hyland, 2006; Lee, 2010) supported the findings of this study. They recommended focusing on both the local and the global, or organization, grammar, and mechanics on the one hand and content on the other. Vyatkina (2011) was also in agreement with this finding. She reported that the majority of the participants felt that providing foreign language programs with corrective feedback on different writing aspects, including both content and appropriateness and grammatical accuracy, was quite useful; using wikis and chats in collaborative writing also allowed learners to concentrate more on different writing components (Elola & Oskoz, 2010). Oskoz and Elola (2011) also reported that computer-mediated communication facilities helped learners in refining the organization of their essays, thus becoming better writers.

Computer-mediated Corrective-feedback Types

This study also investigated the effect of computer-mediated corrective-feedback type (track changes, recast, and metalinguistic) on EFL learners' performance in writing. The findings of this study showed that students who received recast feedback significantly outperformed those who received metalinguistic feedback. Moreover, the results of this study revealed that students who received track-changes corrective-feedback type obtained the highest mean scores compared with the other groups, indicating that it is the most useful computer-mediated corrective-feedback type for developing learners' writing performance on the post-test. This finding was supported by the research carried out to identify the effect of track changes on the development of students' writing abilities. Ho and Savignon (2007), for instance, concluded that most participants think that the track-changes technique is very convenient for providing feedback about writing and facilitates the editing process. Caws (2006) also found that students felt that using track changes in the written evaluations helped them to identify and analyze their errors.

This finding may be attributed to several reasons. First, track-changes corrective feedback has certain advantages as it reformulates the ill-formed text, sentence, phrase, or word through double-striking deletions without providing metalinguistic information about the incorrect form. It also marks insertions in a red color, which reformulates the error and provides the correct form of the problematic word/phrase/sentence. According to Ho and Savignon (2007), the major function of track changes is to record any change in a written text, including notes, questions, insertions, and deletions. This may attract the user's attention to the error. Furthermore, track changes is actually different than either the recast or metalinguistic corrective-feedback types. It is different from the metalinguistic feedback which provides the learner with metalinguistic information or comments about the error explaining the nature of the error indicated and providing a reformulation indirectly. Track changes does not provide metalinguistic feedback about the error; however, it allows for a direct reformulation of the error. Track changes also differs from recast feedback in that the error is always repeated in the correct form and in the reformulation. However, track changes allows for error identification and provides target-like reformulation. The original ill-form produced by the learner was preserved so that he/she could make a cognitive comparison and notice the difference between the error and the suggested correct form. However, the same could not be said for recast corrective-feedback type because the learner's original output (error) was deleted and no longer available. This made it not possible for him/her to make a cognitive comparison. All of this makes track changes a unique corrective-feedback type; it has distinctive characteristics making it different from other corrective-feedback types.

Finally, this study concludes that using the track-changes corrective-feedback type may narrow the gap between explicit and implicit feedback. Many researchers think that there is a connection between

implicit and explicit knowledge bases (DeKeyser, 1998; Hulstijn, 1995), while others (Doughty & Williams, 1998; Long & Robinson, 1998) see implicit and explicit knowledge as being separated and adhere to an intermediate position between these two types. Track-changes corrective feedback can be used in both manners: implicitly and explicitly. That is, there is no direct or metalinguistic feedback showing that an overt error has been committed, so it is implicit. However, the error is identified indirectly and reformulated, so it is explicit. Therefore, it is a learning/teaching method that is different from both explicit and implicit feedback, having unique characteristics and advantages. This may explain the high significant mean scores obtained by students who received feedback using this method. Thus, the use of this method, which is based on technological innovations, may have prospective opportunities for language learning in general and in the area of providing corrective feedback about errors while writing in a more specific way.

Effect of the Corrective-feedback Types on the Writing Aspects

Students in the track-changes group significantly outperformed participants in other conditions in most writing aspects related to both form and content on the writing post-test. Some studies supported this finding. For example, Vyatkina (2011) found that most respondents provided feedback to intermediate-level learners on certain writing aspects, including content, lexical appropriateness, grammatical accuracy, organization, spelling, and punctuation. Students might find an opportunity in the corrective feedback they received from other peers to find their errors and correct them. This finding also entails that corrective feedback should cover comprehensive writing aspects, including content, organization, and form. Restricting corrective feedback to include error correction related to treatable or focused errors may be less helpful in aiding the development of learners' writing abilities. In this way, corrective feedback is not provided in a real writing context, which focuses on developing all writing aspects concurrently. Van Beuningen (2010) and Storch (2010) demonstrated that students might find it confusing when they observe that some of their errors have been corrected while others have not been.

The findings of this study also showed that there was a significant effect in all writing aspects on the post-test except for two: lexical appropriateness and spelling. Students also obtained the lowest means in these aspects. This finding was not expected. Despite the fact that students in the three treatment conditions (track changes, recast, and metalinguistic) had the same opportunities to study the seven writing aspects in the same way during the writing course, they obtained lower mean scores in these two writing aspects. However, this finding may be attributed to the nature of errors related to these writing aspects that students had to find and correct. Most likely, these error types were not focused. That is, students learned to use certain lexical items, but this did not ensure that they learned to use other items because they were different and had different lexical usages. Similarly, spelling errors were generally unfocused (untreatable). Participants might learn the spelling of a number of words. However, this does not necessarily show that they have learned the spelling of other new words compared to other learning focused (treatable) grammatical aspects, such as the definite or indefinite article. The findings in the tables indicated that there was actually an improvement in all students' mean scores on the writing post-test in lexical appropriateness and spelling. However, this does not show an established level of significant effect among the three groups for these writing aspects.

CONCLUSIONS, LIMITATIONS, AND IMPLICATIONS

This study's unique contribution is to look at asynchronous peer-generated computer-mediated corrective feedback and represents a bridge between computer-assisted language learning (CALL) or computer-mediated teaching methods and work being carried out on corrective feedback in language writing. It yielded several major findings. First, students who received computer-mediated corrective feedback while writing achieved better results in their overall test scores than the control subjects who did not receive corrective feedback. Second, there was a significant effect for the track-changes feedback type when compared with the recast feedback and metalinguistic feedback types. Third, students in the track-changes

group significantly outperformed those in the recast and metalinguistic group in most writing aspects. As this may be the first study which has investigated the effect of track changes as a corrective-feedback type while teaching writing, it is still early to claim that it is the best corrective-feedback type to be used by learners, as the issue of how the different types of corrective feedback contribute to language learning "has been and still remains one of the most controversial issues in language pedagogy" (Ellis, 2005, p. 214). Therefore, future research may be conducted using track changes to verify or refute the findings of this study.

Even though providing feedback is still a controversial issue, corrective feedback is commonly used in the classroom. Therefore, it is essential to continue investigating whether or not technology has further implications for the creation of more efficient feedback because the increased use of technology for feedback purposes has been less explored. Track changes is a computer-mediated corrective-feedback type which has its distinguished features and can be described as both partially implicit and explicit, and somewhat metalinguistic and recast in usage. It is a unique method as it is based on error identification and reformulation in which the nature of error is provided indirectly without providing an overt indicator about the error. Therefore, there is a need for conducting more studies related to using different computer-mediated corrective-feedback techniques and which also facilitates the integration of the track-changes feedback type in the teaching and learning of writing, including different modes of commenting and tracking such as Reviewing Panel, Balloons, and Show Markup, and Track Changes Options. It is also essential to continue investigating whether or not technology is providing benefits when compared to the absence of corrective feedback. As the current study has revealed that the presence of certain techniques delivered via computer are more useful in supporting learners' writing performance than the absence of corrective feedback, researchers and pedagogues may think of conducting more studies using other computer-mediated corrective-feedback methods and techniques.

Another implication is related to studies about the effectiveness of corrective feedback using paper-and-pencil. Researchers may think of conducting these studies differently. The need arises to compare between the effectiveness of track changes and paper-and-pencil corrective feedback to find whether it may aid learners in getting more efficient corrective feedback. Researchers may also think of using computer-mediated corrective-feedback methods that focus on both content and form over several sessions. The findings of this study may raise a question about the validity of the methodology and findings of studies that have tested the effectiveness of corrective feedback about focused-error types, or did not provide corrective feedback on unfocused-error types (see, for more information, DeKeyser, 2007; Ferris, 2004, 2010; Storch, 2010; Van Beuningen, 2010). Such studies might not be conducted in a real classroom context where students did not learn how to write; they just examined the effect of corrective feedback on certain error types and ignored others. According to Van Beuningen (2010), conflicting findings on the effect of corrective feedback on developing-learners' writing abilities could be due to methodological issues and study design. Furthermore, in light of the push towards more distance education and the use of online peer and group work in writing courses, this study may present a practical model that can be used as guidance for instruction on the use of peer feedback in language-learning contexts. Finally, this study was based on giving and receiving peer-generated corrective feedback. A future study may compare between the act of giving versus receiving feedback and which of these is responsible for the learning differences observed.

The findings of this study should be interpreted with caution for the following reasons. Firstly, the results are limited to using a specific word processor: *Microsoft Word 2010*. Further studies are needed using other word processors, including their different modes of commenting and tracking changes. Secondly, the study was conducted on a limited sample (sixty-four learners) over a limited period (eight weeks) on certain feedback types (track changes, recast and metalinguistic) in a particular situation. Therefore, there is a need for other studies to be conducted on a greater number of students over longer periods and tracing error type over time. Thirdly, the analysis was restricted to seven major writing aspects. Other studies

may be devised to measure different error types, such as local vs. global, or focused vs. non-focused, and their subcategories using different corrective feedback types in the computer-mediated corrective-feedback environment. Finally, both the experimental and control groups were taught by one of the researchers, which does not make it an ideal situation because the involvement of the researcher in the teaching could introduce bias.

APPENDIX. Vyatkina's (2011) Classification for Writing Aspects and their Operational Definitions

	Writing aspect	Definition	Example	Metalinguistic feedback	Reformulation
1	Content	It includes irrelevance content, long sections, unsuitable examples, redundancy, missing content, senseless ideas (illogical information), and unbalanced discussion.	English language includes four basic skills: reading, writing, and listening.	Missing content	English language includes four basic skills: reading, writing, speaking, and listening.
2	Structural organization (text level)	Ideas follow each other in a logical, coherent order at the text level to make sense to the reader. Errors include the wrong use of transitions, main sentence in the essay, main sentence in each paragraph, and consistency between them and other sentences, and correct paragraph transition.	English is very important to study in schools and universities. Since you have to speak English well these days if you want to get ahead in your study.	Wrong use of transition	English is very important to study in schools and universities. Since Therefore, you have to speak English well these days if you want to get ahead in your study.
3	Structural organization (sentence level)	Ideas follow each other in a logical order at the sentence level to make sense to the reader. Errors include the wrong use of transitions, and connection between words and phrases, and ideas at the sentence level.	I think you have a nice but very nice future if you have good English.	Wrong use of transition	I think you have a nice but very nice future if you have good English.
4	Grammatical accuracy	It includes incorrect word form or word order.	English are the mother language of the world.	Subject-verb agreement	English are is the mother language of the world.
5	Punctuation	This is restricted to the wrong use of punctuation marks.	Finally I think you have a very nice future if you have good English.	Use a comma after the transition	Finally Finally, I think you have a nice but very nice future if you have good English.

6	Lexical appropriateness	It refers to using inappropriate use of lexical items.	You must speak English well if you want to get ahead in your business.	Use should to express advice	You must should speak English well if you want to get ahead in your business.
7	Spelling	It is related to using wrong spelling of words.	English Language is very important in our life these days.	Capitalization	English Language language is very important in our life these days.

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